We Claims as Our Invention:

1. A piezoelectric multilayer actuator of hexagonal cross-sectional geometry, comprising:

at least two individual piezoelectric layers;

at least two electrodes, wherein the electrodes are alternately layered with the piezoelectric layers; and

a housing of circular cross-section.

2. A piezoelectric multilayer actuator as claimed in claim 1, wherein at least one of the electrodes is made of AgPd.

3. A piezoelectric multilayer actuator as claimed in claim 1, wherein at least one of the piezoelectric layers is made of one of the group consisting of $PbTiO_3$, $PbZrO_3$, and PZT.

4. A piezoelectric multilayer actuator as claimed in claim 1, wherein an opening is provided on one side of each of the electrodes.

5. A piezoelectric multilayer actuator as claimed in claim 1, further comprising:

means for alternating external contacting of the electrodes, wherein a multilayer electrode structure is formed which is substantially similar to a multiple plate capacitor.

6. A method for manufacturing a piezoelectric multilayer actuator of hexagonal cross-sectional geometry, wherein the actuator includes at least two individual piezoelectric layers alternately layered with at least two electrodes, the method comprising the steps of:

forming at least two green parts, each green part being provided with an electrode structure on an upper side;

stacking the green parts one over the other;

connecting the green parts to form a compact solid element;

separationally sawing the compact solid element to obtain at least one piezoelectric multilayer element of hexagonal cross-sectional geometry; and

introducing the piezoelectric multilayer element into a housing of circular cross-section.

7. A method for manufacturing a piezoelectric multilayer actuator as claimed in claim 6, wherein the step of connecting the green parts is performed via a sintering process.

8. A method for manufacturing a piezoelectric multilayer actuator as claimed in claim 6, wherein the step of forming the at least two green parts is performed via at least one of foil casting and foil drawing.

9. A method for manufacturing a piezoelectric multilayer actuator as claimed in claim 6, wherein each of the electrode structures is applied to its respective green part via a screen printing process.

10. A method for manufacturing a piezoelectric multilayer actuator as claimed in claim 6, wherein the electrodes are isolated from the compact solid element by parallel saw cuts that are rotated by 60°.

11. A method for manufacturing a piezoelectric multilayer actuator as claimed in claim 6, wherein each of the electrode structures is formed of a regular pattern of a plurality of hexagonal electrodes.

12. A method for manufacturing a piezoelectric multilayer actuator as claimed in claim 11, wherein a plurality waste regions are provided on the each of the electrode structures between the plurality of hexagonal electrodes, the waste regions being filled with a filling material having a thickness substantially equal to a thickness of the electrode structure.

13. A method for manufacturing a piezoelectric multilayer actuator as claimed in claim 6, further comprising the step of:

applying an external contact onto planar external surfaces of the piezoelectric multilayer element.

14. A method for manufacturing a piezoelectric multilayer actuator as claimed in claim 13, wherein, on the planar external surfaces, at least every other electrode includes an opening.

15. A method for manufacturing a piezoelectric multilayer actuator as claimed in claim 13, wherein the step of applying the external contact is performed via a process of laser soldering of electrical contact lugs.